

### **REMARKS**

The Applicants thank the Examiner for the careful consideration of this application. The Office Action dated June 17, 2009 has been received and its contents carefully considered. Claims 2, 3, 5-8, 10-23, and 27-33 are currently pending in this application. Claims 3, 11, 23, 30 and 31 have been amended. No new matter has been added. Based on the foregoing amendments and the following remarks, the Applicant respectfully requests that the Examiner reconsider all outstanding rejections and that they be withdrawn.

#### **Claim Rejection – 35 U.S.C. § 112**

On page 3-4, the Office Action rejects claims 2-3, 5-8, 10-23, and 27-33 under 35 U.S.C. § 112, second paragraph, as indefinite.

On page 3, the Examiner objects to the term "Het" in claim 3 as undefined. Applicants respectfully traverse. The term "Het" is defined in the paragraph spanning pages 12 and 13 of the specification. For this reason, the rejection should be withdrawn. Solely to advance prosecution, the term "Het" has been removed from claim 3, rendering the rejection moot. Applicants reserve the right to further pursue this subject matter.

On page 3, the Examiner objects to certain phrases in claims 3, 11 and 30-31. In response, claims 3, 11, and 30-31 have been amended. Applicants respectfully request the rejections be withdrawn.

On page 4, the Examiner objects to the use of the terms "optionally substituted aryl moiety" and "aryl moiety which may be substituted" in claims 3 and 30-31. Solely to expedite prosecution, Applicants have amended claims 3 and 30-31. Applicants further note for the record that the specification defines "aryl" on page 8, lines 4-15 of the specification to include substitutions. In light of these amendments, Applicants respectfully request the rejections be withdrawn.

On pages 4-21, the Office Action rejects claims 2-3, 5-8, 10-23, and 27-33 under 35 U.S.C. § 112, first paragraph as lacking enablement for the full scope of the claim. Applicants respectfully traverse.

On pages 4-14, the Examiner objects to the use of "Het" containing starting materials in the claimed process. On pages 14-21, the Examiner objects to the use of "Het" containing catalyst system in the claimed process. Applicants disagree, but solely to advance prosecution, Applicants have removed "Het" substituents from claims 3, and 30-31, rendering the rejections moot. Applicants respectfully request the rejections be withdrawn.

Applicants note that claims 2, 5-8, 10-23, 27-28, and 30-33 have not been further rejected under 35 U.S.C. § 102 or 103. Applicants respectfully request these claims be indicated allowable.

**Claim Rejection - 35 U.S.C. §103(a)**

On pages 21-26, the Office Action rejects claims 3 and 29 under 35 U.S.C. §103(a) as allegedly obvious over Drent et al. (EP0495548) in view of Tjaden et al. (US 6,307,065). Applicants respectfully traverse.

Drent et al. describes processes for carbonylation of olefins. In one example, Drent et al. describe the carbonylation of vinylacetate with carbon monoxide in methanol:diglyme to produce a mixture of 1-acetoxy methylpropionate and 2-acetoxy methylpropionate (Example XII). Drent et al. do not use the catalyst system of claim 3, as stated by the Examiner on page 23.

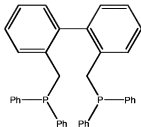
Tjaden et al. describe processes for producing epsilon caprolactones by hydrocarbonylation of an alkadiene, followed by carbonylation of the resulting unsaturated alcohol (e.g. pentene-1-ol) (column 1, lines 52-65). Tjaden describes bidentate phosphine ligands (column 24, line 64-column 25, line 11) used in the carbonylation reaction. The Examiner highlights Example 32 of Tjaden et al., which describes the use of bis(2,2'-diphenylphosphinomethyl)biphenyl as a phosphine catalyst for the carbonylation reaction. The Examiner then asserts that one of ordinary skill would be

motivated to use the bidentate catalyst described by Tjaden et al. in the carbonylation process described by Drent et al. Applicants respectfully disagree.

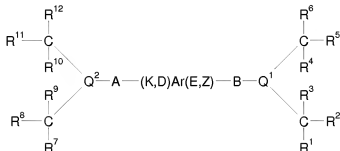
First, Applicants maintain that a person skilled in the art would not be motivated to utilize a catalyst used for carbonylation of a pentene-1-ol to produce  $\epsilon$ -caprolactone in a reaction to carbonylate a vinyl ester. Pentene-1-ol and vinyl esters are different in structure, functionality and, therefore, reactivity. The high level of unpredictability in the field of organic chemistry means that absent some other teaching, there is no reasonable expectation of success. One of ordinary skill would therefore have no reason to use the phosphine compounds described by Tjaden et al. in the process described by Drent et al.

The Examiner asserts on page 24 that Tjaden et al. discloses the use of vinyl acetate or vinyl propionate as the starting material. Applicants disagree. The mention of vinyl acetate as a starting material by Tjaden et al. (column 18, lines 66-67) is used only in a mixture with an alkadiene in the **hydrocarbonylation step** of the two step process described by Tjaden et al. This reaction produces a mixture of alcohols and unsaturated alcohols (e.g. pentene-1-ol) (column 18, lines 33-40). The pentene-1-ol is then separated from the mixture (column 20, line 61-column 21 line 24) and used in the carbonylation step of the two step process described by Tjaden et al. The reaction described by Tjaden et al. using vinyl acetate as a substrate produces an alcohol product, and is not analogous to the reaction described by Drent et al., which produces an ester product. Since the reactions are different, there is no reasonable expectation of success, and one of ordinary skill would have no reason to use the phosphine compounds described by Tjaden et al in the process described by Drent et al.

Applicants point out that **even if** one of ordinary skill had been motivated to use the ligands of Tjaden et al. in the process described by Drent et al., they would not arrive at the invention of claim 3. By way of illustration, bis(2,2'-diphenylphosphinomethyl)biphenyl, the Tjaden et al. compound highlighted by the Examiner, is shown below.



This ligand is different from the claimed compound of formula (I). For illustration, formula (I) and relevant portions of claim 3 are reproduced below.



Wherein:

Ar is a bridging group being an aryl moiety **to which the Q<sup>1</sup> and Q<sup>2</sup> atoms are linked on available adjacent carbon atoms**;

A and B each independently represent **lower alkylene**; and

R<sup>1</sup> to R<sup>18</sup> each independently represent **lower alkyl, or aryl**.

To interpret the Tjaden et al. compound using formula (I), the biphenyl group aligns with Ar, the methylenes between the biphenyl and the phosphorous atoms align with A and B, and the phosphorous atoms align with Q<sup>1</sup> and Q<sup>2</sup>. The Tjaden et al. compound, however, does not meet all the requirements of formula (I). The Tjaden et al. compound does not have an aryl moiety **to which the Q<sup>1</sup> and Q<sup>2</sup> atoms are linked on available adjacent carbon atoms**. Instead, the Tjaden et al. compound has phosphorous atoms linked on separate aromatic rings. None of the catalysts described by Tjaden et al. have Q<sup>1</sup> and Q<sup>2</sup> linked on adjacent carbon atoms of the aryl moiety.

Alternatively, the Tjaden et al. compound can be interpreted using formula (I), by aligning one phenyl group with Ar, either A or B = Ph-CH<sub>2</sub>, while the other is CH<sub>2</sub>, and the phosphorous atoms align with Q<sup>1</sup> and Q<sup>2</sup>. Claim 3, however, defines A and B as **lower alkylene**.

Regardless, the Tjaden et al. compound has two phenyl groups on each phosphorous atom (Q<sup>1</sup> and Q<sup>2</sup>). Formula (I) defines a structure where a saturated quaternary carbon is attached to Q<sup>1</sup> and Q<sup>2</sup> where each of R<sup>1</sup> to R<sup>12</sup> is a **lower alkyl or aryl group**.

For these reasons, **even if** one of ordinary skill would be motivated to use the bidentate catalyst described by Tjaden et al. in the carbonylation process described by Drent et al., the combination does not meet all the limitations of claim 3. Applicants therefore respectfully request the rejections be withdrawn.

Further, the present invention surprisingly produces a highly branched product. Drent et al. gives an example of vinyl acetate carbonylation employing the C3 bridged phosphine 1,3-bis-(di-tert-butylphosphino)propane. The result is the production of 1 and 2 – acetoxy methyl propanoate in a ratio of 40:60 (linear:branched). Tjaden et al, in contrast, describes a carbonylation reaction that produces ε-caprolactone and **linear** hydrates or esters (e.g. 6-hydroxyhexanoic acid and or 6-hydroxyhexanoic acid esters) from unsaturated alcohols (e.g. pentene-1-ol) (column 27, lines 32-40). Tjaden et al., which discloses different ligands provides no teaching on whether carbonylation of vinyl esters is likely to lead to branched or linear product. Again, **even if** one of ordinary skill had been motivated to use the ligands of Tjaden et al. in the process described by Drent et al., the reference suggests a predominately linear product. The increase in branched product provided by the ligands of the present invention is therefore surprising and unexpected.

### Conclusion

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider all presently outstanding rejections and that they be withdrawn. Applicant believes that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition

for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is hereby invited to telephone the undersigned at the number provided.

The Commissioner is authorized to charge any deficiency in any patent application processing fees pursuant to 37 CFR § 1.17, including extension of time fees pursuant to 37 CFR § 1.17(a)-(d), associated with this communication and to credit any excess payment to Deposit Account No. 22-0261.

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Respectfully submitted,

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